MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS-1963-A

ADA044130

ARO-13632.1-A-EL

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

| REPORT DOCUMENTATION PAGE | READ INSTRUCTIONS BEFORE COMPLETING FORM |
|---|---|

| 1. REPORT NUMBER | 2. GOVT ACCESSION NO. | 3. RECIPIENT'S CATALOG NUMBER |
|---|---|---|
| | | ⑨ |

| 4. TITLE (and Subtitle) | 5. TYPE OF REPORT & PERIOD COVERED |
|---|---|
| Investigation of Microprogrammable Microprocessors | FINAL REPORT, October 1, 1975–Jan. 30, 1977 |
| ⑥ | 6. PERFORMING ORG. REPORT NUMBER   1 Oct 75 - 30 Jan 77 |

| 7. AUTHOR(s) ⑩ | 8. CONTRACT OR GRANT NUMBER(s) |
|---|---|
| Yale N. Patt  James W. Hanson | ⑮  DAAG29-76-G-0071  new |

| 9. PERFORMING ORGANIZATION NAME AND ADDRESS | 10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS |
|---|---|
| North Carolina State University  Raleigh, North Carolina 27607 | ⑪ 16 May 77 |

| 11. CONTROLLING OFFICE NAME AND ADDRESS | 12. REPORT DATE |
|---|---|
| U. S. Army Research Office  Post Office Box 12211  Research Triangle Park, NC  27709 | May 16, 1977 |
| | 13. NUMBER OF PAGES |

| 14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) | 15. SECURITY CLASS. (of this report) |
|---|---|
| Frankford Arsenal  Philadelphia, Pa.  ⑫ 4 p. | Unclassified |
| | 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE   NA |

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

DDC  SEP 14 1977

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

⑱ ARO

NA

⑲ 13632.1-A-EL

18. SUPPLEMENTARY NOTES

The findings in this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Microprogramming, Microprocessors, Emulation, Simulation, Intel 3000 Microprocessor, bit dimension, word length.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report briefly summarizes the work performed under Grant DAAG-29-76-G-0071. Extensive technical reports covering the simulator package and the CDC-469 emulated developed under this contract have been submitted to Frankford Arsenal for publication.

DD FORM 1473  EDITION OF 1 NOV 55 IS OBSOLETE    Unclassified
1 JAN 73

259300

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

INVESTIGATION OF MICROPROGRAMMABLE MICROPROCESSORS
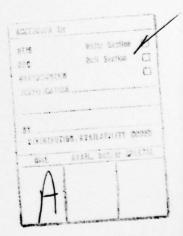

FINAL REPORT



Yale N. Patt
James W. Hanson



May 16, 1977



U. S. ARMY RESEARCH OFFICE



GRANT NUMBER DAAG29-76-G-0071


NORTH CAROLINA STATE UNIVERSITY

RALEIGH, NORTH CAROLINA

This grant, entitled "Investigation of Microprogrammable Microprocessors," provided funding for a study of the potential usefulness of microprogramming when implemented by microprocessors. The basic model of this study was the INTEL 3000 microprocessor. This processor was selected because it allows variable length data words and variable length microinstructions.

A major effort under this grant was the development of a computer programming package which allowed any interconnected network of INTEL 3000 packages to be simulated.

This package was subsequently extended so that in its final form it contained a framework which allowed additional microprocessors to be defined and interconnected networks of such processors to be simulated.

When the simulator was developed to the point where INTEL 3000 networks could be handled, a particular network design was developed for the emulation of the CDC 469. Once this design was completed and the CDC 469 was successfully emulated, a hardware model of the network was constructed. These models were used to design additional microperations for the CDC 469 to control interrupt processing, to increase the speed of memory accesses, and to enhance the power of the instruction set with hardwired immediate instructions.

The program package for the network simulation, the CDC 469 emulator, and the hardware model of the CDC 469 were delivered to Frankford Arsenal in December, 1976. Two final technical reports on this work were also submitted at this time. One report covered the development of the simulator programming package. It is designed to also serve as a user's manual for this system. The second technical report is a reference manual on the hardware model of the CDC 469.

Delays on this contract were the result of difficulties encountered in the design and fabrication of the hardware model. Inconsistencies in the interface to the Model 33 Teletype, which was used as input/output for the model, required major design modifications at a late date in order that these inconsistencies could be accomodated. Problems in obtaining required hardware components, compounded by the United Parcel Services strike during the fall of 1976, led to further delays in the hardware development.

Work on this grant is very closely related to the work on grant number DAAA 25-74-C-502, entitled "Studies of Microprogramming". Experience with the simulator on this grant apply directly to the limitations and feasibility of directly executing a higher level languages on a microprogrammable micro-processor. These experiences will be directly reflected in the Master's Thesis on direct execution of higher level languages by Mr. William Albert which is an outgrowth of the work performed on this aforementioned grant.

A journal article on theoretical work relative to minimizing the bit dimension of the microinstruction is being prepared for publication in the open literations by Dr. Yale N. Patt.

This grant covered the period 1 October 1975 to 30 January 1977 and was supervised by Yale N. Patt, Principal Investigator, from 1 Ocotber, 1975 to 17 May 1976 and by James W. Hanson, as Principal Investigator, from 18 May 1976 to 30 January 1977. William Albert, David Chadwick, D. Lawrence Issacs, and M. Dale Skeen were supported by this grant. The Principal Investigators contributed their time at no cost to the grant.